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Research Regarding the Influence of Genotype, Fertilization and Irrigation on Onion Production in Pre-Mountainous Regions in the Apuseni Mountains

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Abstract. Onion production rate was determined for different types of irrigation: 50% of AHC, 70% of AHC (Active Humidity Coefficient) and non-irrigated version, with organic fertilizers and chemically supplemented organic fertilizers. Research was carried out in 2008, 2009 and 2010.

Keywords: onion, irrigation, fertilization and production rate

INTRODUCTION

There is little data regarding unfavorable meteorological conditions during the growing process of vegetables cultivated in pre-mountainous regions as well as data on growing technology in these conditions. Solid knowledge of such important data can have a positive influence on vegetable growing especially on their production rates.

Vegetable crops must be scientifically irrigated in order to avoid both water excess and drought as these two factors can have negative effects on the quantity and quality of production.

MATERIALS AND METHODS

Over the three experimental years we monitored and determined the influence of soil irrigation on production rates for Stuttgart and Piroska onion varieties with three types of irrigation: 50% of AHC, 70% of AHC and non-irrigated and two versions of fertilization: organic fertilization and mixed fertilization (organic and chemical), respectively.

Variance analysis and Duncan test were used to process and interpret the data collected over the three experimental years.

Multifactorial variance analysis was used in the experiments conducted in the three years in order to establish the simultaneous effect of several experimental factors on a certain feature that was analyzed (Ardelean, 2006).

With the help of Duncan test we have been able to compare objectively the differences between any two variants as such comparisons are based on different values of DS5% (significant difference for P=5%), calculated according to observed value differences between the average values of the two variants taken into consideration. This is why this test is also called the test of multiple comparisons (Ardelean, 2006).

RESULTS AND DISCUSSIONS

Results pertaining the influence of genotype, fertilization and irrigation scheme on

onion production were obtained in a series of trifactorial experiments conducted for three years in the same spot. Several factors were considered: productivity characteristics (the size, diameter and height of the bulb) as well as elements of quality which influence indirectly the productivity of this variety (dry matter content). Finally bulb production for the designed area was analyzed.

Not surprisingly, the three experimental factors studied (genotype, fertilization scheme and the amount of water used for irrigation) had a different influence on bulb production rate calculated per area unit. Table 1 shows the analysis of the three-factor experiment that was considered.

Tab. 1

Variance analysis regarding bulb production t/ha in a series of trifactorial experiments 2x2x3, Băişoara 2008-2009-2010

Variance Table					
	SPA	GL	s^2	F Sample (i)	
Total	7220	107			
Repetitions	6	6			
Genotype	1645.4892	1	1645.5	40.67	>7.71
Fertilization	1126.947	1	1126.9	27.85	>7.71
Irrigation	2426.6	2	1213.3	29.99	>6.94
Years	84.816067	2	42.41	1.05	<6.94
G x F	198.20941	1	198.21	4.90	<7.71
G x I	76.5	2	38.24	0.95	<6.94
G x Y	407.1498	2	203.6	5.03	<6.94
F x I	4.6950042	2	2.35	0.06	<6.94
F x Y	235.28552	2	117.64	2.91	<6.94
I x Y	52.120758	4	13.03	0.32	<6.39
G x F x I	110.9	2	55.43	1.37	<6.94
G x F x Y	104.85	2	52.42	1.30	<6.39
G x I x Y	417.98327	4	104.50	2.58	<6.39
G x F x I x Y	161.9	4	40.46		
Error	161.22	70	2.30		

Table 1 shows that F sample for genotype, fertilization and irrigation has higher values than the values calculated for P5%, which means that only the three experimental factors had a significant influence on the variability of experimental forms, the interaction between factors on the one hand and between experimental years on the other hand being insignificant. For these reasons we have considered that a good enough presentation of the results would be in the form of bilateral tables in which the separate influence of two factors and the interaction between them are shown.

Duncan test (DS5%) was used for establishing the significance of the difference; therefore interactions can inevitably show significant differences between extreme values as well (Tab. 2, 3, 4).

Tab. 2

Influence of fertilization and irrigation on onion bulb production t/ha, Baisoara 2008-2009-2010
FxI Analysis

Fertilization	Non-irrigated	Irrigated 50	Irrigated 70	F average
Organic	17.2	22.7	29.2	23.0 A
Organic+NPK	23.9	29.5	35.1	29.5 B
Irrigation average	20.6 M	26.1 N	32.2 P	

DS 5 % for two fertilization average values (F)= 3.7
DS 5 % for two irrigation average values (I)= 4.3-4.5
DS 5 % for two interaction average values (F x I)= 7.4-8.8

Observation: The difference between any two values followed by at least one common letter is insignificant.

The analysis of the influence of fertilization on bulb production shows that organic fertilization and NPK supplemented fertilization led to significant differences between the production rates of the two onion varieties. Logically, bulb production rate of those NPK supplemented was 6.5 t/ha higher.

As far as irrigation water level is concerned, the differences among all three versions (non-irrigated, irrigated 50% of AHC and 70% of AHC) are significant; the best production rate in the two experimental years was obtained for each onion variety in irrigated 70% of AHC version.

Production rates decrease significantly by diminishing the amount of irrigation water to 50% of AHC and even more significantly on non-irrigated plots where the water used by the crops was strictly rain water.

The data in table 2 indicates that NPK supplemented organic fertilization, irrigated 70% of AHC is the most efficient version in terms of bulb production. By far the lowest bulb production rates were obtained in non-irrigated versions regardless of the fact that fertilization was with or without mineral NPK supplementation.

By analyzing the data in table 3 one can easily notice that the greatest influence on bulb production t/ha was obviously that of the genotype. Practically, Stuttgart variety ensures a higher bulb production rate (7.8 t/ha higher) than Piroska variety, the difference between the two genotypes being quite significant. Since in the previous table we have presented and discussed the results regarding irrigation influence, we will limit the discussion to the influence of the interaction between irrigation and genotype. Thus, according to the data in table 3 Stuttgart variety has the highest production rate when irrigated 70% and 50% of AHC respectively, the differences between these two versions of irrigation being significant as well. In the non-irrigated version Stuttgart variety has a significantly lower bulb production rate than the irrigated one. As it was expected, Piroska variety is inferior to Stuttgart variety regardless of the irrigation level.

Tab. 3

Influence of genotype and irrigation on bulb production t/ha, Baisoara 2008-2009-2010.
ANALYSIS G x I

Genotype	Non-irrigated	Irrigated 50	Irrigated 70	G average
Stuttgart	23.3	30.8	36.4	30.2 A
Piroska	17.8	21.4	27.9	22.4 B
Irrigation average	20.6 M	26.1 N	32.2 P	

DS 5 % for two genotype average values (G)= 3.0
DS 5 % for two irrigation average values (I)= 4.3-4.5
DS 5 % for two interaction average values (G x I)= 7.4-8.8

Observation: The difference between any two values followed by at least one common letter is insignificant.

Of all the data in table 4 we will discuss the interaction between the two factors as the separate influence of factors was discussed based on the previous table.

Tab. 4

Influence of genotype and fertilization on bulb production t/ha, Baisoara 2008-2009-2010.
ANALYSIS G x F

Genotype	Org	Org+NPK	G avergae
Stuttgart	25.6	34.8	30.2 A
Piroska	20.5	24.2	22.4 B
Fertilization average	23.0 M	29.5 N	

DS 5 % for two genotype average values (G)= 3.0
DS 5 % for two fertilization average values (F)= 3.7
DS 5 % for two interaction average values (G x F)= 7.4- 8.8

Observation: The difference between any two values followed by at least one common letter is insignificant.

Obviously Stuttgart variety has the highest bulb production rates regardless of the irrigation level both for organic fertilization version and mineral NPK supplemented fertilization version. The differences between these versions are significant in this respect for this onion variety.

For Piroska variety there are also significant differences between bulb production rates for the two levels of fertilization. Unfortunately, the production rates are extremely low, even unusual for such an onion variety which is destined to produce bulbs.

CONCLUSIONS

On the basis of the results regarding the production rates in the three experimental years we have drawn the following preliminary conclusions:

- Bulbs/ha genotype had the greatest influence on bulb production, which is why we recommend that the onion variety should be chosen carefully taking into account the pedological and meteorological conditions that are typical for pre-mountainous regions.
- In these pedological and meteorological conditions, organic fertilization (30 t/ha farmyard manure) and mineral NPK supplemented fertilization (30:30:30) lead to approximately the same results, which suggests that, as far as economy is concerned, NPK supplemented fertilization is not efficient.

- Even in pre-mountainous regions irrigation brings about a significant increase in onion production rates, especially when the soil humidity is ensured at a level of 70% of AHC.

REFERENCES

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